

IN THE CLAIMS:

Kindly change claims 1, 9, 25, 34 through 38, and 40, all to read as follows.

1 1. (currently amended) Apparatus for printing a desired  
2 image on a printing medium, based upon input image data,  
3 by construction from individual marks of at least one col-  
4 orant, formed in a pixel grid; said apparatus comprising:  
5 for each colorant, at least one respective multiele-  
6 ment printing array that is subject to colorant-deposi-  
7 tion error, including error in image intensity;  
8 means for measuring such colorant-deposition error  
9 of the at least one array;  
10 means for modifying a multicolumn, multirow numeri-  
11 cal tabulation that forms a mapping between such input  
12 image data and such marks, to compensate for the measured  
13 colorant-deposition error, including error in image in-  
14 tensity; and  
15 means for printing using the modified mapping.

1 2. (original) The apparatus of claim 1, wherein the  
2 mapping is selected from the group consisting of:  
3 an optical-density transformation of the image data  
4 to such construction from individual marks; and  
5 a spatial-resolution relationship between the image  
6 data and such pixel grid.

1 3. (original) The apparatus of claim 2, wherein:  
2 the optical-density transformation comprises a half-  
3 toning matrix; and  
4 the spatial-resolution relationship comprises a  
5 scaling of the image data to such pixel grid.

1 4. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 said at least one multielement printing array com-  
4 prises a plurality of multielement printing arrays that  
5 print in a corresponding plurality of different colors or  
6 color dilutions, respectively, each multielement printing  
7 array being subject to a respective colorant-deposition  
8 error; and  
9 the measuring means and the mapping-modifying means  
10 each operate with respect to each one of the plurality of  
11 multielement printing arrays respectively.

1 5. (original) The apparatus of claim 4, wherein:  
2 for at least one of the plurality of multielement  
3 printing arrays, the colorant-deposition error comprises  
4 a respective pattern of printing-density defects; and  
5 wherein:  
6 the measuring means comprise means for measuring the  
7 pattern of printing-density defects for each multielement  
8 printing array respectively; and  
9 the modifying means comprising means for applying  
10 the respective pattern of defects, for at least one of  
11 the multielement printing arrays, to modify a respective  
12 said mapping.

1 6. (original) The apparatus of claim 4, wherein:  
2 for at least one of the plurality of multielement  
3 printing arrays, the colorant-deposition error comprises  
4 a swath-height error;  
5 the measuring means comprise means for measuring the  
6 swath-height error for each multielement printing array  
7 respectively; and  
8 the modifying means comprise means for applying the  
9 respective swath-height error, for at least one of the  
10 multielement printing arrays, to modify a respective said  
11 mapping.

1 7. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 the colorant-deposition error comprises a pattern of  
4 printing-density defects;  
5 the measuring means comprise means for measuring the  
6 pattern of printing-density defects;  
7 the modifying means comprise:  
8  
9 means for deriving a correction pattern from  
10 the measured pattern of printing-density  
11 defects, and  
12  
13 means for applying the correction pattern to  
14 modify a halftone thresholding process;  
15 and  
16  
17 for each colorant, the printing means comprise means  
18 for printing such image incrementally, using the modified  
19 halftone thresholding process.

1 8. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 the colorant-deposition error comprises a swath-  
4 height error or otherwise corresponds to an optimum dis-  
5 tance of printing-medium advance;  
6 the measuring means comprise means for measuring the  
7 swath-height error or determining the optimum distance;  
8 the modifying means comprise:  
9  
10 means for deriving a correction pattern from  
11 the measured swath-height error or deter-  
12 mined optimum distance, and  
13  
14 means for applying the correction pattern to  
15 modify a halftone thresholding process;  
16 and  
17  
18 for each colorant, the printing means comprise means  
19 for printing such image incrementally, using the modified  
20 halftone thresholding process.

1 9. (currently amended) A method of printing a desired  
2 image, by construction from individual marks of at least  
3 one colorant, formed in a pixel grid by at least one mul-  
4 tielement printing array that is subject to a pattern of  
5 printing-density defects, including error in image inten-  
6 sity; said method comprising the steps of:  
7       measuring such pattern of printing-density defects;  
8       deriving a correction pattern from the measured pat-  
9 tern of printing-density defects, including error in im-  
10 age intensity;  
11       applying the correction pattern to modify a halftone  
12 thresholding process that uses a halftoning matrix which  
13 is a predefined numerical array;  
14       wherein the applying step comprises preparing a  
15 modified form of the predefined numerical array, and then  
16 using that modified form of the array; and  
17       for each said colorant, printing such image by said  
18 at least one multielement array respectively, using the  
19 modified halftone thresholding process.

1 10. (previously presented) The method of claim 9, for  
2 use with a printmask in plural-pass printing, said print-  
3 mask being a defined system of numerical values, distinct  
4 from the measured pattern of defects and distinct from  
5 the derived correction pattern, that establishes the  
6 printing pass in which each ink mark is to be made; and  
7 further comprising the steps of, before or as a part of  
8 the applying step:

9       using such printmask to determine a relationship be-  
10 tween the halftone matrix and the multielement array; and  
11       employing the relationship in the applying step to  
12 control application of the correction pattern to the  
13 halftone matrix.

1 11. (original) The method of claim 9, wherein:  
2       the printing step comprises single-pass printing.

1 12. (original) The method of claim 9, for use with said  
2 at least one multielement incremental-printing array that  
3 comprises a plurality of scanning multielement printing  
4 arrays that print in a corresponding plurality of differ-  
5 ent colors or color dilutions, each multielement printing  
6 array being subject to a respective swath-height error;  
7 and wherein:

8       the measuring, deriving, applying and printing steps  
9 are employed to modify swath height of at least one of  
10 the scanning multielement printing arrays, for accommo-  
11 dating any swath-height error present in each multiele-  
12 ment printing array respectively.

1 13. (original) The method of claim 9, for use with said  
2 at least one multielement incremental-printing array that  
3 comprises a plurality of multielement printing arrays  
4 that print in a corresponding plurality of different  
5 colors or color dilutions, each multielement printing ar-  
6 ray being subject to a respective pattern of printing-  
7 density defects; and wherein:  
8 the measuring, deriving, applying and printing steps  
9 are each performed with respect to each multielement  
10 printing array respectively.

1 14. (original) The method of claim 13, for use with  
2 such plurality of multielement incremental-printing ar-  
3 rays that are also each subject to a respective swath-  
4 height error; and wherein:  
5 the measuring, deriving, applying and printing steps  
6 are also employed to modify swath height of at least one  
7 of the multielement printing arrays, for accommodating  
8 any swath-height error present in each multielement  
9 printing array respectively.

1 15. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises defini-  
3 tion of a halftone matrix.

1 16. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises an  
3 error-diffusion protocol.



1 17. (original) The method of claim 16, wherein the  
2 error-diffusion protocol comprises at least one of:  
3 a progressive error-distribution allocation protocol  
4 of such error-diffusion halftoning; and  
5 a decisional protocol for determining whether to  
6 mark a particular pixel.

1 18. (original) The method of claim 9, wherein:  
2 the applying step comprises replacing values above  
3 or below a threshold value.

1 19. (original) The method of claim 9, wherein:  
2 the applying step comprises multiplying values by a  
3 linear factor.

1 20. (original) The method of claim 9, wherein:  
2 the applying step comprises applying a gamma correc-  
3 tion function to values.

1 21. (original) The method of claim 9, wherein the modi-  
2 fying step comprises a combination of at least two of:  
3 replacing values above or below a threshold value;  
4 multiplying each values by a linear factor; and  
5 applying a gamma correction function to values.

1 22. (original) The method of claim 9, wherein:  
2 for each of the plurality of multielement arrays,  
3 the measuring, deriving and applying steps are each per-  
4 formed at most only one time for a full image.

1 23. (original) The method of claim 9, wherein:  
2 the applying step comprises modifying the darkness  
3 of substantially each mark printed by an individual  
4 printing element whose density is defective.

1 24. (original) The method of claim 9, wherein:  
2 the applying step comprises modifying the average  
3 number of dots printed by an individual printing element  
4 whose density is defective.

1 25. (currently amended) A method of printing a desired  
2 image, based on input image data, by construction from  
3 individual marks of at least one colorant, formed in a  
4 pixel grid by at least one scanning multielement printing  
5 array; said printing being subject to print-quality de-  
6 fects due to departure of printing-medium advance from an  
7 optimum value, and also including error in image inten-  
8 sity; said method comprising the steps of:  
9       measuring a parameter related to such print-quality  
10 defects;  
11       based on the measured parameter, scaling such input  
12 image data to compensate for said departure; and  
13       for each said colorant, printing such marks with  
14 said at least one scanning multielement array using the  
15 scaled input image data.

1 26. (original) The method of claim 25, wherein:  
2       the parameter comprises such print-quality defects;  
3 and  
4       the measuring step comprises measuring such print-  
5 quality defects.

1 27. (original) The method of claim 26, wherein:  
2       the defects comprise swath-height error; and  
3       the measuring step comprises measuring swath-height  
4 error.

1 28. (original) The method of claim 26, wherein:  
2 the defects comprise area-fill nonuniformity; and  
3 the measuring step comprises:  
4  
5 using a sensing system to measure area-fill  
6 nonuniformity for plural printing-medium  
7 advance values, and  
8  
9 selecting a printing-medium advance value that  
10 corresponds to minimum area-fill non-  
11 uniformity.

1 29. (original) The method of claim 25, wherein:  
2 the parameter comprises such optimum value; and  
3 the measuring step comprises determining such opti-  
4 mum value.

1 30. (original) The method of claim 25, for use with  
2 said at least one scanning multielement printing array  
3 that comprises a plurality of multielement printing ar-  
4 rays that print in a corresponding plurality of different  
5 colors or color dilutions, each multielement printing ar-  
6 ray being subject to a respective swath-height error;  
7 wherein:  
8 the measuring, scaling and printing steps are each  
9 performed with respect to each multielement printing  
10 array respectively.

1 31. (previously presented) The method of claim 30,  
2 wherein:  
3 at least some of the different printing arrays have  
4 optimum advance values or swath-height values that are,  
5 respectively, different from one another; and  
6 the printing step comprises:  
7  
8 comparing optimum advance values or swath-  
9 height values measured for the plurality  
10 of multielement printing arrays respec-  
11 tively, to find the smallest of said  
12 values;  
13  
14 selecting a particular multielement printing  
15 array whose said value is substantially  
16 the smallest;  
17  
18 using, in common for the plurality of printing  
19 arrays, substantially said selected small-  
20 est value; and  
21  
22 for substantially each array other than the  
23 particular array, operating with a respec-  
24 tive reduced number of printing elements  
25 and with rescaled data, to match an actual  
26 effective swath height of the particular  
27 array.

1 32. (original) The method of claim 31, wherein:  
2 said smallest of said values is determined taking  
3 into account the maximum available number of printing  
4 elements in the corresponding array.

1 33. (original) The method of claim 25, further compris-  
2 ing the step of:  
3 after the scaling step, iterating the measuring and  
4 scaling steps to allow for nonlinearity in such print-  
5 quality defects.

1 34. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:  
5 at least one multielement incremental-printing array  
6 that is subject to colorant-deposition error, including  
7 error in image intensity;  
8 means for measuring such colorant-deposition error  
9 of the at least one array;  
10 means for modifying a multicolumn, multirow numeri-  
11 cal tabulation that forms a mapping between such input  
12 image data and such marks, to compensate for the measured  
13 colorant-deposition error, including error in image in-  
14 tensity; and  
15 means for printing using the modified mapping;  
16 wherein the multielement printing array is an inkjet  
17 printhead.

1 35. (currently amended) A method of printing a desired  
2 image, by construction from individual marks formed in a  
3 pixel grid by at least one multielement printing array  
4 that is subject to a pattern of printing-density defects,  
5 including error in image intensity; said method compris-  
6 ing the steps of:  
7       measuring such pattern of printing-density defects,  
8 including error in image intensity;  
9       deriving a correction pattern from the measured pat-  
10 tern of printing-density defects;  
11       applying the correction pattern to modify a halftone  
12 thresholding process that uses a halftoning matrix which  
13 is a predefined numerical array;  
14       wherein the applying step comprises preparing a  
15 modified form of the predefined numerical array, and then  
16 using that modified form of the array, to correct the er-  
17 ror in image intensity; and  
18       printing such image using the modified halftone  
19 thresholding process;  
20       wherein the multielement printing array is an inkjet  
21 printhead.

1 36. (currently amended) A method of printing a desired  
2 image, based on input image data, by construction from  
3 individual marks formed in a pixel grid by at least one  
4 scanning multielement printing array; said printing being  
5 subject to print-quality defects due to departure of  
6 printing-medium advance from an optimum value, and also  
7 including error in image intensity; said method compris-  
8 ing the steps of:  
9       measuring a parameter related to such print-quality  
10 defects;  
11       based on the measured parameter, scaling such input  
12 image data to compensate for said departure; and  
13       printing such image using the scaled input image  
14 data;  
15       wherein the multielement printing array is an inkjet  
16 printhead.



1 37. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks of at least  
4 one colorant, formed in a pixel grid; said apparatus  
5 comprising:  
6       for each colorant, respective means for printing  
7 incrementally in that colorant;  
8       each said printing means, for a particular one col-  
9 orant, comprising at least one respective incremental-  
10 printing array that is subject to colorant-deposition  
11 error, including error in image intensity;  
12       means for measuring such colorant-deposition error  
13 of the at least one array;  
14       means for modifying a multicolumn, multirow numeri-  
15 cal tabulation that forms a mapping between such input  
16 image data and such marks, to compensate for the measured  
17 colorant-deposition error, including error in image in-  
18 tensity;  
19       wherein the numerical tabulation is not a halftone  
20 screen; and  
21       means for printing using the modified mapping.

1 38. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:  
5 at least one multihundred-element printing array  
6 that is subject to colorant-deposition error, including  
7 error in image intensity;  
8 means for measuring such colorant-deposition error  
9 of the at least one array;  
10 means for modifying a multicolumn, multirow numeri-  
11 cal tabulation that forms a mapping between such input  
12 image data and such marks, to compensate for the measured  
13 colorant-deposition error, including error in image in-  
14 tensity; and  
15 means for printing using the modified mapping.

1 39. (previously presented) The apparatus of claim 38,  
2 wherein:  
3 the multihundred-element array has at least three  
4 hundred printing elements.

1 40. (currently amended) Apparatus for printing a de-  
2 sired image on a printing medium, based upon input image  
3 data, by construction from individual marks formed in a  
4 pixel grid; said apparatus comprising:

5 at least one multielement incremental printing  
6 array, having at least thirty printing elements, that is  
7 subject to colorant-deposition error, including error in  
8 image intensity;

9 means for measuring such colorant-deposition error  
10 of the at least one array;

11 means for modifying a multicolumn, multirow numeri-  
12 cal tabulation that forms a mapping between such input  
13 image data and such marks, to compensate for the measured  
14 colorant-deposition error, including error in image in-  
15 tensity; and

16 means for printing using the modified mapping.

1 41. (previously presented) The apparatus of claim 40,  
2 wherein:

3 the at least one multielement incremental printing  
4 array comprises a scanning printhead or a full-page-width  
5 printhead.

1 42. (previously presented) The apparatus of claim 40,  
2 wherein:

3 the printing means comprise at least one micropro-  
4 cessor controlling all of the at least thirty elements  
5 simultaneously during printing to select, and selectively  
6 actuate, particular elements for printing of particular  
7 pixels respectively.